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Visibility in Street Lighting

NOW that the Sheffield Conference, fully reported in our last issue, is over, it may be well to look back over the proceedings and comment on one or two of the most interesting problems touched on in the discussions. The series of model installations in the streets of Sheffield naturally proved to be the dominating topic, and perhaps rather tended to distract attention from the papers read. Some of the latter, however, notably Mr. J. M. Waldram's analysis of visibility, contained material that well deserves study.

It is only within quite recent years that much attention has been given to the processes connected with visibility in street lighting, which is a more complex problem than was formerly imagined. Earlier investigators were concerned mainly with illumination. The criterion of minimum illumination adopted by the joint committee which reported in 1913 has much to recommend it. "Surely," it was argued, "the main function of public lamps is to ensure that every point in a street is adequately illuminated; judgment should be based on the weakest link in the chain." But there were also critics who urged that this criterion alone was insufficient, and that it was absurd to place on equal terms two streets having the same minimum illumination but receiving widely different fluxes of light as a whole. Moreover, even at that time it was recognized that the distribution of *brightness* in a street may depart widely from the curve of illumination. There are, however, several reasons why this fact was not regarded as of the same importance as to-day. In the first place, motor traffic had not assumed its present volume. In the second place, the modern type of road surface, dark in texture but raised to a high degree of polish by the ceaseless impact of wheels of motor-driven vehicles, was then less widely used.

Both these qualities, the dark colour of the surface and its shininess, accentuate the divergency between curves of brightness and illumination. They also tend to put a premium on "visibility by silhouette," especially in wet weather when objects are detected mainly by the aid of direct reflections of light-sources off the roadway. In such circumstances it is true to say that visibility may depend more on the position of light-sources than on the distribution of their light. These considerations all lead one to attach less importance to extreme uniformity of illumination.

But, according to Mr. Waldram's paper, there are other facts which support this conclusion. Even disregarding effects of polished reflection, it is by no means certain that highly uniform illumination is favourable to visibility. Some experiments made with the model box were instructive in this respect. A very even illumination—a species of "moonlight effect"—produced from lamps at a high level, seemed to be particularly unsuccessful from the standpoint of visibility, besides giving a rather monotonous and unpleasing general effect. On the other hand, a "freak" system of illumination, consisting of rapid alternations of shadow and brightness, though doubtless undesirable in practice for other reasons, was, in fact, good as regards visibility. In no position in a street could the test object be made to disappear. Such a result, though at first sight surprising, is capable of explanation. The chief factor in determining visibility is contrast beween the object and its background. If both receive the same illumination this contrast may be insufficient for good visibility, especially at the low degree of illumination customary in streets. But if, as is possible with the freak system mentioned above, the illumination received respectively by the object and by the road surface is widely different the contrast may be accentuated.

This experience, therefore, again seems to suggest that extremely uniform illumination is not an unmixed blessing. There is yet another reason why it is inexpedient to aim too closely at this ideal. With lamps spaced far apart a high degree of uniformity can only be obtained in one way—by accentuating the illumination at the minimum point mid-way between lamps. This involves a very high candle-power at angles slightly below the horizontal, and inevitably by so doing the glare from distant lights is increased.

One result of the conference at Sheffield will, we think, be to drive home a recognition of the vital importance of diminishing glare in street lighting. In this matter personal peculiarities count for a good deal. Some people seem almost unconscious of a degree of glare that is intensely annoying to others. But few people who took part in the special tests in the streets of Sheffield would escape the conclusion that the effect of adjacent light-sources often interfered considerably with their judgment of the test-disc; in quite a number of cases it was possible to detect the "spot" with the eyes shaded by the hand when it was otherwise impossible to do so. The effect of glare is often only appreciated when it is eliminated. The experience cited by Mr. Waldram—the relief experienced

by the eye when an intervening obstacle, a tree-trunk or a lamp-post, comes in front of a distant lamp—bears this out. We should have liked to have seen included amongst the installations at Sheffield one designed on the lines suggested by Dr. Walsh at the Public Works and Transport Congress last year, i.e., a sharp cut-off applied so as to prevent all but the first source being seen.

Tests of glare are notoriously difficult. It is not easy to contrive any test which will take into consideration all the influences which unduly bright sources may exert in the streets, the sense of discomfort, the reduction of visibility, and the momentary distraction of the eye which may result in a motoring accident. But a complete test of this kind might reveal several facts that are not sufficiently appreciated; for instance, that even distant lights may have a troublesome effect on vision, and that glare from a source is only lessened but not eliminated when it is seen "out of the tail of the eye," or is far away. It is possible also that it might lead to a revision of the opinion that in street lighting glare depends primarily on candle-power rather than on brightness.

The troublesome interference of glare, which impairs our efforts to secure uniform illumination, also makes its appearance in connection with vision by silhouette. It is true that objects on the roadway are in practice largely detected by the aid of the bright background furnished by directly reflected images of light-sources. Yet such reflections, which approach in brightness the actual sources of light, may give rise to considerable glare. We recall the experience of a public lighting engineer in a Continental city, who was seriously considering abandoning central suspension simply on account of the troublesome reflections continually visible all the way down the street. This form of glare is lessened and the efficacy of the silhouette effect increased when mantles or filaments are screened with diffusing material, so that images are of greater area and diminished brilliancy.

This brief analysis may serve to show the extraordinary complexity of the problems confronting the public lighting engineer. At the present moment we should be inclined to say that the most pressing problem is the reduction of glare. It is right that the present limitations of vision in artificially lighted streets should be recognized and taken into consideration. But we should bear in mind future possibilities and should not take too narrow a view. In discussions on street lighting there is a tendency to consider almost exclusively the needs of traffic. This is a most important aspect, yet it is not and can never be the only one. Such questions as the general appearance of the lighting units and the street as a whole, and especially the illumination of surfaces of buildings, cannot be ignored.

Again, while for the moment it seems as though the perception of objects is effected mainly by "silhouette," and we must plan our systems accordingly, illuminating engineers should not rest content with this poor ideal. Our ultimate aim should be to furnish conditions of illumination such that perception is effected by processes more nearly resembling those that apply in the day-time; in other words we should be able to see objects in their entirety by the light falling upon them, to distinguish not only their outline but their form. It may seem at the moment impracticable to furnish the intensities of illumination necessary for this process. But the problem does not depend exclusively on intensity of light, and there is much that might be done by other means. The inherent weaknesses of street lighting are due not so much to the poor intensity as to the imperfect diffusion of light. When illumination is derived solely from widely separated sources, and objects receive illumination from one or two directions only, they must necessarily be seen imperfectly. Our aim should be to approach more nearly the diffusion of light characteristic of interior lighting. This we can do, not merely multiplying the number of public lamps and diffusing their light, but by encouraging supplementary methods of illumination. Light derived from brackets attached to private buildings, floodlighting, illuminated shop-windows, and even mildly luminous electric signs, all help towards removing the uncomfortable impression caused by a few bright points of light amidst dark surroundings. The same end may be obtained by providing surfaces of lighter textures by which rays of light from street lamps may be diffused. How different, for example, would be the appearance of many London streets if the coating of grime were removed from the buildings lining it! By such methods we can improve street lighting and relieve the eye by at least three distinct processes—by promoting better diffusion of light and more even illumination, by extending luminous surfaces so that the images from a shiny road surface overlap and become continuous, and, last but not least, by providing a mildly luminous background so that the eye is no longer in a state of dark-adaptation and undue sensitiveness, liable to be distracted by isolated points of light, even of moderate brightness.

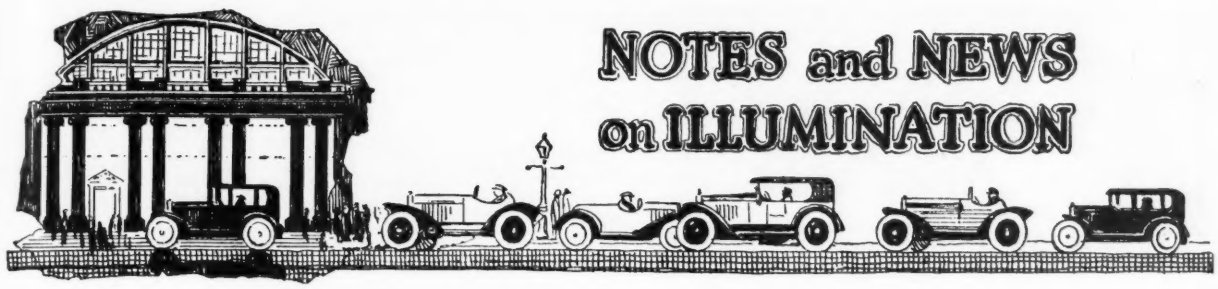
The International Illumination Congress in the United States

BY the time this number appears the British delegates to the International Illumination Congress in the United States, which commences next month, will have left our shores.

Some further particulars of the conference, and of the various papers to be read, will be found on page 256. The Congress as a whole embodies two distinct functions. There is the session of the International Commission on Illumination—the first held in the United States—and there is also the annual convention of the American Illuminating Engineering Society, at which, as usual, a number of interesting papers will be read. A preliminary list of about 70 delegates from countries other than the United States has been already published. We are glad to see that Great Britain will be well represented, amongst the delegates from this country being Mr. C. C. Paterson, who is this year President of the International Commission on Illumination.

These two events, however, do not exhaust the interest of the proceedings, for visitors will be afforded unique opportunities of inspecting lighting installations and learning of progress in illumination in the United States. As many of these installations will be inspected jointly by American and foreign delegates, an excellent opportunity will be afforded for the exchange of views. The actual presentation of reports and papers at these international conferences forms only one of their useful functions. At least equally important is the opportunity afforded for illuminating engineers from various countries to get to know one another and to form friendships which help to advance illuminating engineering throughout the world.

No doubt, at the opening meeting of the Illuminating Engineering Society in this country in November next, something will be heard of the experiences of British delegates. Meantime all readers will join with us in wishing them a thoroughly enjoyable and instructive trip.



Association of Public Lighting Engineers

CONFERENCE IN BOURNEMOUTH, 1929.

We are asked to mention, for the benefit of members of the Association and others who were unable to be present at the recent Conference in Sheffield, that the next Annual Meeting and Conference of the Association of Public Lighting Engineers will be held in Bournemouth. The exact date will be announced later. Bournemouth should prove an attractive meeting place, especially as we understand that substantial improvements in the public lighting of this seaside resort are now being made.

Atmospheric Pollution

The report of the Committee charged with the investigation of atmospheric pollution for the past year* is specially interesting in view of the fact that it covers the period of the coal stoppage, which extended from May 1st to December 1st, 1927. It is somewhat surprising to find that in London the strike had apparently little effect on the degree of atmospheric pollution. In Stoke-on-Trent, however, where much smoke is developed by the pottery industries, the effect was quite marked.

We note that the investigation is now being extended to other countries, records having been initiated in Stockholm, Melbourne and elsewhere. An interesting item is the curve prepared by Dr. Leonard Hill showing the relation between the amount of ultra-violet energy transmitted and smoke pollution. The curve roughly resembles a hyperbola. The ultra-violet radiation becomes negligible with a comparatively low content of smoke in the air, corresponding with a smoke pollution index number of " 6." On the other hand as the pollution approaches zero the curve mounts rapidly, apparently becoming almost vertical. Presumably, as there is naturally a limit to the ultra-violet radiation present, the curve must meet the vertical ordinate somewhere; but as yet insufficient data have been obtained to enable the equation of the curve to be determined.

Artificial Lightning

We understand that artificial lightning flashes at a potential of 1,500,000 volts will shortly be available in the Stanford University, California. The generator devised by Mr. F. W. Peek of the General Electric Co. (U.S.A.), for this work will be the first high voltage unit to employ cable-type capacities in place of the glass type. These impulse voltages will be used mainly for the study of high tension transmission systems. The laboratory in which these tests will take place has recently been remodelled in order to render possible potentials of 3,600,000 volts. Although described as "artificial lightning" even these discharges occur at pressures much below real lightning discharges. It is estimated that in nature potentials of the order of 100,000,000 volts may be realized. Owing, however, to the height of transmission lines above the ground, and to the flash-over values of insulators at present in use, the voltages induced by lightning on the lines are usually not more than two or three per cent. of the magnitude of the total potential between the clouds and earth. Hence the pressures afforded by the impulse generator at Stanford University will fulfil the requirements of tests.

* The Investigation of Atmospheric Pollution, Thirteenth Report issued by the Department of Scientific and Industrial Research, and published by H.M. Stationary Office : 6s. 6d. net.

The Lighting of the House of Commons

The somewhat unusual system of lighting in the House of Commons, by means of lamps mounted above the diffusing glass roof, seems to have captured the imagination of the press and allusions to it are frequent. In some respects the system has advantages, though we should imagine that the intensity of illumination, even to-day, is not unduly high. The chief criticism that we have heard is that the predominantly downward direction of the light renders it somewhat difficult to see the faces of speakers—an obvious hardship to cartoonists. To get a good idea of the expression on a speaker's face one needs to be able to see the eyes, the " windows of the soul," clearly. If the light comes exclusively from above, the illumination of the features may not be adequate, and the eyes are apt to be lost in shadow.

Tail-Lights on Horses

At the Public Safety Congress last year one of the authors strongly endorsed the carrying of rear lights by cyclists. Another contributor recommended pedestrians to wear light-coloured overcoats or mackintoshes when out at night, and we notice that the President of the Danish Automobile Club has been advising girls to wear light-coloured silk stockings. Another novel step is reported from Bradford, where, it seems, mounted constables are to carry tail-lights. According to *The Daily Chronicle*, this decision was the result of a recent street accident when one of the mounted constables was run down by a motor car at night. For this purpose a small electric lamp, to be carried on the crupper of the horse, has been developed. Perhaps it will be only a question of time before pedestrians will also be asked to wear rear lights at night.

Obituary

ARTHUR BEZANT.

WE record with deep regret the death of Mr. Arthur F. Bezant, Editor of *The Gas Journal*, who died on July 31st. He had been associated with *The Gas Journal* for many years; first on the staff, later as Editor, and finally as joint managing director. The journal was, in fact, his life work. To all he did he brought an extraordinary degree of thoroughness, and there were few indeed who surpassed him in general knowledge of the details of the gas industry, which he served so well. He took a keen interest in the Circle of Scientific, Technical and Trade Journalists, which was largely the creation of the late Mr. Leon Gaster, and he followed with interest the work of the Illuminating Engineering Society, to whose proceedings he frequently referred in *The Gas Journal*. He was naturally widely known in the gas industry, but he had many friends outside. His sterling character won general respect, and his kindly shrewdness made him always a pleasant companion. The gas industry has lost a trusty friend, and technical journalism one of its most able representatives.

The World Engineering Congress, 1929

We have received particulars of the coming World Engineering Congress, which is to be held in Tokyo in October, 1929. We are glad to note that the Illuminating Engineering Society in Japan is interesting itself in the Congress and that " Illuminating Engineering " forms one of the subjects on the schedule. No doubt some useful papers reviewing progress in this field will be presented. We notice that the official languages at the plenary and sectional sessions will be English and Japanese, so that the papers will no doubt be presented in a form which British engineers can understand.

Traffic Lights in New York City

According to *Nation's Traffic*, the use of traffic-control lights in New York City has effected a saving estimated at over 12 million dollars. There are at present 2,500 electric traffic signals in operation, and their removal would probably mean the employment of 5,000 additional policemen. Further extensions during 1927 will include installations at 425 additional crossings, doing the work of 850 police officers. It will be seen that according to this estimate luminous traffic control has proved very successful in New York, and we believe that the same applies to other cities. The uniform system of laying out American streets has doubtless contributed to this result. How far the method will prove acceptable in the varied and irregular streets of London is less certain, though we understand that fully automatic systems have been installed and have given good results in various provincial cities, notably in the Yorkshire area.

Electric Signs on Ships

An interesting development, the adoption of luminous signs for ships, is discussed in a recent issue of the *Transactions* of the Illuminating Engineering Society (U.S.A.). Electric lighting has for long played an important part on the giant liners. But it is only recently that such vessels have begun to carry their names in bold illuminated designs. The first boat to be thus equipped is the s.s. *France*, which has a sign nine feet long. The possibility that ships may carry luminous signs for purposes of advertisement is also discussed. At first sight this may seem a strange suggestion; but to-day the ocean is not quite the lonely place it was, and aerial traffic is already coming into the picture. Advertising at sea may, therefore, ultimately become profitable.

Electric Lighting in Calcutta

A contributor to *Electrical Industries* makes some notes on the progress of electric lighting in Calcutta, which has been considerable during recent years. Not only is the European section of the city lighted mainly by this means, but even in the native quarter the familiar kerosene lamp is becoming unusual. He states that it would be difficult now to find a house in the city where electricity has not been installed, except in the case of the clusters of old huts (" basties "), which are gradually being swept away. It comes as a surprise, however, to learn that it is only this year that the first electric sign has been installed in Chowringhee, the Piccadilly of Calcutta. What is needed, in order to popularize the illuminated sign in the native area, is the substitution of the vernacular for English.

Illumination at the Leipzig Fair

The Leipzig Fair this year promises to be of special interest to illuminating engineers. We understand that on this occasion not only the leading firms in the lighting industry in Germany, but also the numerous smaller concerns who specialize in various types of fittings will be represented. Of late years there has been increasing rivalry between the makers of traditional metal fittings and those of wood, porcelain and other materials. The range of materials in use has extended greatly and it will be interesting to observe what progress in unusual designs is being made. We notice that the Fair will synchronize with the annual meeting of the *Verband der Beleuchtungsgeschäfte Deutschlands*, and this in itself should ensure the presence of many leading makers. *Licht und Lampe* emphasizes the opportunity afforded of securing the Christmas trade. An attempt is being made in Germany to encourage people to make Christmas presents of electric fittings for the home, and no doubt there are great possibilities in this field. *The Illuminating Engineer* will be specially represented at the Leipzig Fair, and we hope to have some interesting details to put before our readers.

Decorative Lighting in France

Further interesting examples of decorative lighting are to be found in *Lux*, our French contemporary. In the latest issue there is a series of striking pictures which includes the arcades of the Champs-Elysees and the dining room of the liner Ile-de-France. In these installations diffusing glassware plays a conspicuous part, the steamship dining room being illuminated by a large number of panels mounted in the ceiling—a system of lighting which is also likely to be developed more extensively in this country. We are glad to notice that *Lux* also abstracts Mr. Cooper's recent analysis of electric lighting in the engineering industry.

A Review of Progress in Illumination

An enterprising step has been taken by the Lighting Section of the *Société Francaise des Electriciens*, which has prepared a series of brief reports reviewing progress in illumination. Eleven such reports have just been presented, and appear in the June issue of the *Bulletin* of the Society. M. Maisonneuve deals with incandescent lamps, and M. Marsat with lighthouses, projectors, etc. M. Wetzel contributes some notes on interior lighting and M. Desarces reviews recent developments in public lighting in France. M. Maurice Leblanc is himself responsible for three contributions dealing respectively with arc lamps, the use of electric light in kinema film-making, and biological effects of light. M. Fonseque reviews progress in electric signs. Two special contributions are those of Dr. Couvreaux, which discusses physiological optics, and Dr. Saidman, which is devoted to therapeutic applications of light. The various contributions, though usually brief, cover wide ground. A feature is the attention paid to physiological aspects of illumination, with which no less than three out of the eleven reports are concerned. We are glad to see that it is proposed to make the series of reports an annual feature. This step may be regarded as an indication of the keen interest with which developments in illumination are now followed in France.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

The Production and Application of Light

(In what follows we give a summary of the Annual Report of the Committee on Production and Application of Light, which was presented at the Summer Convention of the American Institute of Electrical Engineers at Denver, Colorado, last year. Mr. Preston S. Millar, the Chairman of this Committee, has kindly sent us a copy of this report, which contains an informative survey of recent developments.—ED.)

DEVELOPMENTS in the production of light during the past year have mainly taken the form of refinements of design and adaptations of existing types, rather than radical departures in principle. There are, however, many interesting modifications and new applications of lighting apparatus to record.

Production of Light

INCANDESCENT FILAMENT LAMPS.

Small Multiple Lamps.—Within the past year a new and smaller 10-watt tungsten filament lamp for 110-, 115-, or 120-volt service has been placed upon the market. This lamp has a bulb $1\frac{5}{8}$ inches in diameter and a new base termed "intermediate," and constitutes a new size in the group of multiple lamps. It has been developed for places where physical limitations make the use of lamps of previously existing standard types difficult or impracticable. It is designed to yield an average life of 1,500 hours at a rated efficiency of 7.85 lumens per watt, and is available in coated bulbs in any of seven colours, the coatings being of a nature to withstand outdoor service. This lamp is expected to find wide use, especially in electric signs of the smaller sizes.

Another new lamp employing the intermediate base has recently been developed. This lamp is rated at 10 watts, 115 volts, and is designed to yield an average life of 600 hours at a rated efficiency of 8.95 lumens per watt. It is intended primarily for lighting of Christmas trees, and is available in coated bulbs in any of seven colours.

Very Large Lamps.—The successful production of incandescent lamps in sizes up to the 10-kilowatt lamp marks a distinct advance in the art of lamp manufacture and prepares the way for even larger sizes if they shall be needed. These extremely large lamps are manufactured for special purposes, such as the lighting of aviation fields and motion picture studios. These applications are still in the developmental stage, though many installations are functioning satisfactorily.

Projection Lamps.—A new development in the manufacture of incandescent lamps of the smaller sizes for projection purposes is the use of the "coiled-coil" filament by means of which the overall dimensions of the light source are materially reduced, an object which is much sought in light projection. The resulting increase in uniformity and intensity of screen illumination has been a considerable factor in the growing popularity of home motion picture projection.

In certain types of concentrated filament lamps for light projection, more accurate and automatic positioning of the filament is attained through the use of a prefocussed base consisting of a separate sleeve attached to an unthreaded base shell after the lamp has been otherwise finished.

The overall dimensions of filaments of 750- and 1,000-watt lamps for general service have been reduced in the interest of improved accuracy of light projection in floodlighting and of better distribution in the case of high-mounted industrial reflectors.

Street Railway Lamps.—Two new lamps in inside frosted bulbs have been made available during the past year for street railway service. One of these is a 36-watt vacuum type coiled filament lamp designed for operation five in series on circuits of from 525 to 650 volts. The other is a low-voltage, gasfilled lamp designed for operation at 30 volts per lamp, with approximately 20 lamps in series on the street railway circuit. This lamp has a special device incorporated in the lead-in wires by means of which the circuit is re-established in case of the failure of the lamp filament.

Carbon Lamps.—Though the use of carbon filament lamps shows a decrease each year, the numbers sold each year are still considerable. Carbon lamps seem to be particularly popular in coloured bulbs and in bulbs of special decorative or novelty types. For purposes of illumination their use is, of course, uneconomical, but for decorative use they appear to meet a certain small demand.

Operating Voltages.—Progress in the standardization of lighting circuit voltages continues. It is estimated that 94 per cent. of the population within reach of electric service is in territories served by some one standard voltage (110, 115 or 120), and that more than 99 per cent. is within territories served by one or more than one standard voltage, leaving only a fraction of 1 per cent. distributed among the odd voltages between 100 and 130. The voltage used most generally is 115. It is estimated that 59 per cent. of the population within reach of electric service is provided with electricity at this voltage.

SEARCHLIGHTS.

Recent developments in military searchlight design have been towards greater beam candle-power, lighter weight, greater mobility and improved methods of control.

There were two important developments in 1927:—

(1) The incorporation in the searchlight unit of a comparator system, enabling the searchlight to be guided from a distance by accurate data transmitted electrically from a sound-locator station to the searchlight station.

(2) The successful production of a 60-inch mobile searchlight unit, employing a 250-ampere high intensity arc operated by a 25-kilowatt generating unit, and developing 1,385,000,000 maximum beam candle-power.

In order to facilitate signalling, searchlights of the smaller sizes in the navy are being adapted to the employment of the incandescent lamp. Similar signalling searchlights, using 1,000-watt projection lamps, have unique advantages in the submarine service in that the pressure on the projection drum may be equalized by allowing water to enter the unit

Gaseous Conductor Lamps.

Sign Types.—The neon tube lamp for display and sign service has grown in popularity. By using mixtures of gases, and also by the employment of fluorescent glass tubing, varied colour effects are obtainable, though some are not entirely stable at the lowest temperatures. These signs require a relatively high voltage. The power factor is usually below 50 per cent. when supplied with alternating current, but the efficiency of the orange-red neon tube sign is relatively high and the guaranteed service life is long.

The vivid colour contrast with daylight offered by neon tube signs tends to promote their use in day-time as well as at night.

Hot Cathode Lamps.—The hot cathode neon lamp consists of a glass tube similar in form to that of the mercury-vapour lamp now in general use, but filled with neon gas. The discharge through the gas is started and facilitated by the heating of the cathode. The voltage drop at the electrode is thus reduced from 250 to 30 volts, making possible the operation of the lamp directly on a 115-volt alternating-current or direct-current circuit. The absence of electrode disintegration permits the passage through the tube of a comparatively large current, with a resultant high intrinsic brilliancy and candle-power. It has been tried with some success in the illumination of opal letter signs, in the marking of pier heads and aviation fields, and (in the form of a close spiral mounted at the focus of a parabolic reflector) as an airway beacon. This new form of neon lamp may be used in combination with the mercury-vapour lamp to produce with high efficiency light which is apparently white in colour and which is expected to find application in colour and panchromatic photography.

Negative Glow Lamps.—The negative glow socket type neon lamp has undergone further development during the past year. The present form of this lamp is designed for operation on 115-volt alternating-current circuits. It consumes about one-third of a watt and emits somewhat less than one-tenth of a candle-power. Its field of use is primarily that of an indicator or night lamp. The corresponding lamp for direct-current service is under development but is not yet available.

Television Lamp.—A prominent position in the recent successful demonstrations of television has been occupied by a neon lamp of a type specially designed for that class of service. The neon lamp is uniquely adapted to that purpose by virtue of its instantaneous response to variations of voltage.

Induction Lamp.—The electrodeless discharge in neon, in the form of the induction lamp, has recently been employed experimentally as a light source for airway beacons. The bulb enclosing the luminous gas is of clear fused quartz about 1½ in. in diameter and is mounted at the focus of a searchlight reflector. A short wave pliotron oscilator mounted in the reflector housing generates the high-frequency current necessary to excite the gas within the bulb. Owing to its orange-red colour, the neon induction beacon is said to excel other sources of equal beam candle-power in visibility at a distance in both clear and foggy weather.

Interior Illumination

Industrial Lighting.

The year has witnessed advances both as to the general standards of industrial lighting and the extent to which modern methods are employed. A recent survey even showed that in one industrial area the electrical energy consumed for lighting approximately equalled that used for power purposes.

The Department of Labour and Industry, State of Pennsylvania, has adopted regulations for emergency lighting of places of public assembly and places where persons work after darkness. The rules call for an emergency illumination of at least half a foot-candle on the floor at exit doors, hallways, etc., leading to outside building exits, and of at least a quarter foot-candle on the floors of auditoriums. Control of the supply must function without dependence upon manual operation. The source of energy must be separate from that of the main lighting system, and when secured from outside the building must be supplied by two generating stations, an approved automatic throw-over switch being required

Commercial Lighting.

The past year has revealed a more widespread application of illumination and a better appreciation of its utilitarian and advertising value. While the present practice in the majority of stores and offices is to provide general illumination with diffusing-glass enclosing globes, there is a growing demand for lighting equipment of the semi-indirect type. Special fittings designed along the lines of modernistic art have appeared. These innovations in design may lead to radical changes in types of commercial lighting equipment.

In the lighting of window displays the tendency has been to advance to higher intensities as the level of street illumination has risen and as the number and brilliance of electric signs have increased. The use of coloured lighting and the employment of spotlights to create striking contrasts have been practised extensively during the past few years.

A more general use of colour-matching units is notable, but practice in artificial daylighting is in need of clarification.

Residence Lighting.

The Modernistic Trend in Lighting Equipment.—For several years European artists and designers, notably the French, have been striving to develop a style which will express twentieth-century tendencies. Their work has influenced furnishings of all kinds, including lighting fixtures. These modernistic fixtures usually employ plane rather than curved surfaces and strong, pronounced lines. Colour is used to advantage and there is remarkable absence of unnecessary applied decorative bits. Almost without exception exposed bare lamps find no place in this equipment. The lamps are generally hidden from view, the light being diffused by some external medium.

This modernistic movement is beginning to find its way into American homes and may have a considerable effect on home-lighting practice.

Use of Light for Ornament.—Attention is drawn to the development abroad of artistically lighted pieces of decoration. These lighted ornaments furnish no useful illumination, but give touches of high light in colour about a room. They have been very aptly termed " the jewellery of the lighting installation." In the past year many such devices have been imported and one of the leading American manufacturers has placed on the market a line of such ornaments.

Residence Wiring.—The increasing cost of residence wiring and the growing tendency toward unreasonable restrictions in the use of materials and methods are believed in certain quarters to be serious hindrances to the development of the residential use of electricity. Consequently, study has been devoted during the last few years to the problem of surmounting these obstacles. The three important factors responsible are: lack of adequate skill in planning the average residence wiring system; lack of economical wiring materials; and the tendency to employ the electric wiring codes as obstructions to new development and progress.

The first condition is being corrected in many localities through the employment by the central station companies of home lighting experts and by the propagation of the so-called " Red Seal " plan. As regards the other two unfavourable influences there is considerable agitation for the development of lighter and less expensive wiring materials and for the modification of the electrical codes, if necessary, to permit the use of such materials.

Theatrical Lighting.

The growing importance of stage lighting in dramatic production has led to the institution of a course in stage lighting in the Department of Drama at Yale University. This is perhaps the first serious attempt to teach lighting as a part of dramatic production. The course involves a comprehensive study of the science of lighting, particularly from the standpoint of history, physics, psychology, electricity, illumination, instruments, and control. This is followed by the study of the use of light on the stage and by practice on regular productions.

Motion Picture Lighting.—The almost universal use of panchromatic films and the closer attention to operating efficiencies and economies are two principal factors which have favoured the adoption of incandescent lamps in some studios. It is also stated that the labour and power costs for lighting are reduced. Also the system is more flexible, more easily controlled, and more pleasing to those working under it than are others. Producers of the so-called talking pictures have found incandescent lighting desirable in order that the noises of arc lamps may not be recorded.

A general illumination of from 200 to 500 foot-candles over the entire area to be photographed is usually needed. In addition, concentrated beams of from two to five times these values are needed for modelling the principal actors or for bringing out certain parts in contrast with the rest of the set. Incandescent lamps of sizes up to 10-kw. rating are used.

A development in equipment for amateur motion photography is a portable reflector containing a standard 500-watt, T20 bulb, 100-volt projection lamp to be operated on the usual 115-volt house lighting circuit. This over-voltage operation, while reducing the average life of the lamp from the normal figure of 50 hours to about 5 hours, greatly increases the amount of light produced as well as its actinic value and renders possible the use indoors of amateur motion picture cameras which have heretofore been dependent upon outdoor illumination.

During 1927 there has been developed and placed on the market a new type of motion picture projector which utilizes a 60-ampere high intensity arc with an ellipsoidal reflector as optical condenser equipment. With this new type of projector it has been possible to obtain screen brilliances equivalent to those previously obtained with a 120-ampere high intensity arc and the usual condenser lens system.

Exterior Illumination

Street Lighting.

A method of remote control for street lighting circuits employing high frequency carrier-current impulses transmitted along the same conductors as the power current has been developed. The principal advantage of this method of remote control is that the power conductors are utilized for the transmission of control impulses without interference with their own function and without need for additional control conductors. It possesses a high degree of flexibility and is not subject to limitation of distance between transmitter and receiver to the same extent as is a pilot-wire control system. The first practical installation of the carrier-current control system was made in Schenectady, N.Y. Later installations have been made in Bayonne, N.J., Rochester, N.Y., San Francisco, Calif., and Boston, Mass.

Relation Between Street Lighting and Motor Vehicle Headlighting.

Obviously there is a close relation between street lighting and motor vehicle headlighting. If adequate street and highway lighting were everywhere available, there would be no necessity for powerful headlight beams. Unfortunately it is not economically practicable to illuminate all roads over which motor vehicles travel. On the other hand, as adequate lighting of streets and highways becomes more extensive, driving for a considerable part of the time with dimmed or deflected headlights is becoming more possible of realization.

Powerful headlights, such as are necessary to illuminate a highway, have serious limitations. Known methods of eliminating glare from the eyes of other users of the highways are only partially effective and are not universally applied. Such glare is a source of discomfort and hazard. The most hopeful solution lies in the fixed lighting of highways carrying heavy traffic. In well-lighted streets the glare from automobile headlights is less serious but is still objectionable, and the avoidance of powerful beams under these conditions is now being encouraged. The Committee on Street Lighting of the Illuminating Engineering Society has sought the co-operation of the Committee on Motor Vehicle Lighting of the same society in the consideration of this question. As a result of the joint deliberations, the following resolution was adopted on March 7th, 1928, as representing the views of both committees:

"Resolved that, in the opinion of the Illuminating Engineering Society Committee on Street Lighting and of the Illuminating Engineering Society Committee on Motor Vehicle Lighting, powerful headlights on automobiles as used in open-road driving are unnecessary and undesirable upon adequately lighted streets. Upon such adequately lighted streets the practice of dimming or depressing headlight beams is desirable and should be encouraged.

"It is further the opinion of these committees that it is practicable at this time to provide such adequate street light for traffic thoroughfares of American cities. In general, street lighting on such thoroughfares is believed to be adequate for this purpose when the street area between curb lines is illuminated to an average horizontal intensity of $\frac{1}{4}$ foot-candle or more. This illumination can be obtained even under unfavourable conditions by an expenditure of about 100 lumens per linear foot of street. Where light is applied most effectively, and other conditions are favourable, a materially smaller value of generated lumens will produce adequate illumination and will suffice for driving with dimmed or depressed headlight beams."

Automobile Headlighting.

The chief features of automobile headlight design during the past year involved structural improvements and the more extended use of the depressible beam system with two filament lamps.

Headlight construction has often been so poor that permanency of adjustment could not be expected, and in many cases close adjustments have been difficult to obtain. Recently there has been a material betterment. The incandescent lamps used are being made to closer factory standards, particularly with respect to positioning of the filament (axial alignment and light centre length), so that the day seems to be approaching when focussing adjustments on headlamps can be safely abolished. This will bring a great relief to the motorist and better average headlighting conditions on the road.

Headlight beams with a wide lateral spread below the horizontal are regarded as advantageous in night driving and the tendency is to use front glasses on headlamps which will give these wide spreads. This method, however, tends to reduce the beam intensities below a desirable limit. The use of the 21 candle-power lamp is extensive. In many states the use of higher candle-powers is prohibited. From a technical standpoint, however, it appears that proper illumination over the wide area which should be illuminated involves the use of higher candle-power lamps, and the raising of the limit to 32 candle-power has been recommended.

The dual beam headlighting system has been approved by all states as legal and has met with wide popularity. A large proportion of the new cars is now being provided with this equipment. A great amelioration of the glare difficulty is obtained by the use of the depressed beam, and since the driving beam can be removed from the eyes of passing drivers the adjustment of the headlamps may be such that the top of the beam is of higher candle-power than with the fixed beam equipment. Hence a better driving light is possible when the absence of oncoming cars renders it practicable to keep the beam in its normal position.

Further research to determine the most satisfactory methods of automobile headlighting is now being carried out.

Signal Lighting for Traffic Control.

On November 15th, 1927, under American Engineering Standards Committee procedure there was approved as an American Standard a Code of Colours and Forms for Traffic Signals for Highways and Vehicles. This code includes lights used upon vehicles and also luminous signals used for traffic control, but it does not include non-luminous signs. The code establishes the use of green for GO, red for STOP, and yellow for CAUTION, and gives a scientific specification for these three colours. The code includes the type of signal to be used at railroad grade crossings to indicate the approach of a train.

The subject of non-luminous traffic signs is to be covered in a report of a committee of the American Engineering Council on Street Signs, Signals, and Pavement Markings. This report will deal with the choice of colours, forms, wordings, mounting positions, mounting heights, and various other details of street traffic signs as well as recommended practices for pavement markings. It is attempting to standardize the control of right and left turning movements where luminous signals are used in the hope of achieving some uniformity in the use of such signals. It favours the use of red and green only rather than red, yellow, and green; but where yellow is to be used it is hoped that it may be used in a uniform manner in all communities. Its report is now in the hands of a sectional committee of the A.E.S.C.

The A.E.S.C. code already approved provides that automobile headlights shall be white, yellow, or some intermediate hue. Tail-lights are to be red and rear signalling devices are to be yellow. Other red and green lights are not to be displayed on either the front or the rear of vehicles. Conformance to this code will require the abandonment of red and green lights for route markers and for rear signalling devices.

In line with the standardization of the use of coloured lights, the American Engineering Standards Committee has already approved of green as the standard colour for exit lights from theatres and similar buildings.

Sign Lighting.

The National Electric Light Association in 1928 sponsored two schools of electrical advertising which were held at the respective lighting institutes of the Edison and National Lamp Works of the General Electric Company. On these occasions the necessity for co-operation between the various branches of the industry for the purpose of improving the value of this advertising medium was emphasized. The projection of advertisements upon low clouds in the sky has been made possible by the development of a huge lantern slide projector, but the application of this method has not as yet proved generally practicable, being limited by meteorological conditions.

The animated bulletin board type of sign consisting of figures painted with saturated colours and illuminated alternately by light of different hues continues to grow in popularity in spite of its limited colour range.

Porcelain enamelled steel letters are being used more extensively than in former years, particularly in connection with large roof signs, owing to their ability to withstand exposure to the weather and the ease with which they may be cleaned. The recent use of chromium-plated channel letters and borders in electric signs may be noted, and likewise the increasing popularity of the neon tube. Specular reflections from these chromium-plated surfaces tend to multiply the apparent number of lamps in the sign, and the non-corrodible nature of the material is a distinct advantage.

It is stated that during the last four years about 700 neon electric signs have been installed in the New York metropolitan area and that more than 4,500 such signs have been installed throughout the United States.

Lighting of Building Exteriors.

The floodlighting of office and public buildings has advanced rapidly during the last few years, and architects have shown more interest in its possibilities. In the case of tall buildings the trend of practice is to light the upper stories, which are visible from the greater distances. The modern setback style of construction favours this method. During the past year there has been a distinct tendency toward the employment of colour in floodlighting. One of the most notable recent examples of coloured floodlighting is the new 23-story building of the Philadelphia Electric Company. This is lighted above the 15th story with continuously changing tints of four colours. This installation comprises a total of 467 projectors consuming 262 kw., which is equivalent to about 9 watts per sq. ft. of lighted area.

Another interesting method of floodlighting buildings not exceeding 100 ft. in height is the installation of projectors in the ornamental tops of street-lighting posts located along the curb.

Lighting of Railroad Yards.

Floodlighting is becoming recognized as the standard method for the artificial illumination of railroad yards. The Committee on Illumination of the Association of Railway Electrical Engineers has continued its active study of this subject, and, with the assistance of a subcommittee comprising specialists in photometric and illuminating engineering work, has prepared a "General Procedure for Photometry of Incandescent Floodlights" which it has recommended for adoption as standard practice for testing and rating floodlighting projectors.

Railroad Signalling.

During 1927 automatic signals were installed upon 5,127 miles of railroad. This record has not been equalled in any previous year. The preference for light signals is indicated by the fact that, of the total number of signals installed during 1927, 74 per cent. were light signals and 26 per cent. were semaphore. The proportion of light signals tends to increase from year to year. Of the light signals installed during 1927, 82 per cent. were coloured lights, 16.8 per cent. were position lights, and 1.2 per cent. were colour position lights. One of the outstanding developments of 1927 was the placing in service of a centralized dispatching system on the Ohio division of the New York Central Railroad. This installation represents the accomplishment of the idea of operating trains by signal indication without written train orders or operators at intermediate stations. All signals and passing side switches are power-operated and under the control of the dispatcher at a central point.

Lighthouses.

Since the first practical application of the incandescent electric lamp to large lighthouses at Cape Henry Light in 1922, practically all of the coastal lighthouses of large size in this country have been so equipped wherever central station service is available or where a local generating plant can be maintained. During the past year ten light stations and three lightships were equipped with electricity. Small electric lights, the current for which is supplied by a battery of primary cells, are to some extent being substituted for oil-burning post lights on inland rivers and similar locations. These outfits have been designed to operate without attendance for several months. A recent development is the automatic lamp-changing device, actuated by a no-voltage relay, which swings into focus and lights a spare lamp in the event that the first lamp burns out in operation.

Special attention has been paid to the design of filaments of incandescent lamps for lighthouse work, and this, in conjunction with the frosting of bulbs, has resulted in several types which represent a considerable improvement.

(To be continued.)

Electric Mine Lamps and Better Lighting*

By WM. MAURICE, F.G.S., M.I.E.E.

IT is recorded that, on the night of his execution, King Charles I was found reading in his office by the light of a mortar. A "mortar," it may be explained, was a metal bowl for holding wax and with a wick for burning. Mortars were used as "mort lights" or "death lights," and were indeed of little use for earthly purposes. They were used round biers at the time of the Reformation, because the use of candles round a bier was an indictable offence.

The mining historian who sets out to record the way in which coal was being mined 300 years later will be obliged to confess that the light employed was no better, and probably a little worse, than that which last served King Charles. It will surely seem strange to him that in an industry, the greatest dangers of which arise from want of light, so very little attention should have been paid to the provision of it. During the 100 years between 1817 and 1917 it was common usage to think chiefly in terms of lamps, for it was only towards the end of that period that there came to be an appreciable difference between one lamp and another.

During the next decade, when electric lamps became familiar in mines, the historian will be surprised to find that lamps were still being bought as "lamps" without reference to their lighting value. He will, however, note with interest the growth in the number of electric lamps in use, and he will observe that the electric lamp, like other early safety lamps, was originated in the Newcastle district. He will find that during the period 1911–1927 the number of electric lamps in use had increased to about 365,000, but he will be surprised to find that 95 per cent. of these lamps were of truly mediæval lighting value.

The Two-Volt Lamp.—The practical effect of the great revision of mining legislation involved in the Coal Mines Act, 1911, was to render obsolete many flame lamps of low grade, and thus to pave the way for extensive trials of the new method of lighting mines. The official competition, with prizes to the value of £1,000, initiated by the late Sir Arthur Markham, greatly encouraged the development of new forms of lamps; 195 lamps were submitted. The principal prize (£600) went to Mr. Faerber, of the Concordia Elektrizitäts Aktien Gesellschaft, of Dortmund, and the prize lamp came to be known as the "Ceag," from the initial letters of the winning firm. Eight other firms were awarded prizes of £50 each, but only one of the eight has since been widely adopted. There were, however, a few lamps of established reputation which were not submitted. Evidently the judges expected to find a 2 candle-power lamp, but the winning lamp was reported to be of 1½ candle-power, and the statutory candle-power dwindled to one all round in a horizontal plane, throughout a period of not less than ten hours, and of not less than 1.5 over an arc of 45°, the use of a reflector being permitted.

To-day it is difficult, too, for any two-volt lamp to pass even this low test. In practice the average maximum value at starting is only about 0.75 candle-power. After eight hours the general average will be about 0.55 with a clear glass, tested under laboratory conditions. Allowing for defective batteries, bad contacts, progressive blackening of bulbs and dirty well glasses, it becomes evident that the average pit-lighting value of two-volt lamps is considerably less than half a candle-power. To this must be added a further loss—anything from 5 to 20 per cent.—resulting from the use of freak cover glasses (yellow, blue, etc.). It is a wonder that any light is left at all!

However, the two-volt electric lamp served a useful purpose in leading to improvements in flame lamps. In 1912 there was issued the first official list of approved lamps. Soon after came the war and a general period of dislocation. It was inevitable that dissatisfaction should arise, leading to the appointment of a committee in 1921 to inquire into possibilities of improvement as regards safety and illumination.

The Two-part Lamp.—Four years later attention was drawn to a new design which led to a division of electric mine lamps into "three-part lamps" (i.e., those with separate accumulators) and "two-part lamps" (i.e., lamps in which the accumulator is built into the outer case). To-day the "three-part" system is already obsolete—except in England, France and Belgium—and the two-part construction is now represented by 2, 2.6 and 4 volt models.

The reports of the Miners' Lamp Committee contained no reference to this development nor to the use of alkaline batteries; but a paper read by Prof. McMillan, of University College, Nottingham, last year illustrated the results, as regards higher candle-power, with lamps of the alkaline type. A lamp of the latter type gave 45 per cent. more candle-power than that furnished by lamps with the ordinary lead cell.

The Alkaline Battery.—It is curious that the alkaline battery is still largely unknown. There are, in fact, three distinct types of such batteries. The first was the Edison nickel-iron lamp, which did not succeed in this country. To-day every alkaline lamp of practical value is of the nickel-cadmium type; though this, again, may be subdivided into several distinct varieties.

There are to-day four ways in which underground lighting may be improved: (1) By the use of better hand lamps, (2) by the more extended use of cap lamps, (3) by the use of auxiliary lamps, and (4) by the adoption of one of the dozen or so systems of lighting from electric or compressed-air mains.

Hand lamps will probably always be required for reasons which will occur to every mine manager. There are two possible directions of advance: to use alkaline lamps or four-volt lamps. Lamps with separate accumulators have already gone out of use in nine out of twelve countries. The primary aim is to get more light. The four-volt lamp is an amplification of the first two-part two-volt lamp, which has interesting electrical features. In the State mines of Holland there are 25,000 of these lamps in use, and they are in course of being changed from two to four volts. About 6,500 are already four-volt lamps, 3,500 being at the Hendrik mine and 2,500 at the Mouritz. The latter is probably the largest pit in the world. It has a lamp room to accommodate 7,200 lamps, of which 6,500 will be electric and 1,200 flame lamps. At the Minister Stein Colliery, Dortmund, there are also 2,000 four-volt lamps.

The newest alkaline lamp is designed on the same two-part concentric principle as the two- and four-volt lamps. It has Edison tubular electrodes, and utilizes a nickel-cadmium-lithium combination of active material. A thousand of these lamps have been working in Russia for more than a year, and a further 25,000 will replace an equivalent number of two-volt lamps in German mines during the next three months.

Cap Lamps and Auxiliary Lamps.—The general case for the cap lamp has been presented by Dr. T. Lister Llewellyn and Prof. W. H. MacMillan this year. Here again the two-part principle is followed. The new four-volt type has interesting features. The cost of cap lamps is not materially greater than that of efficient hand lamps. They have been stated to be more difficult to house, but complete lamp-room equipment is now available which obviates this drawback.

The use of auxiliary lamps doubtless is due to the fact that two-volt lamps give no light worth mentioning at the coal face. Lamps suitable for this purpose have been available for some time, but have not been in demand. Latterly it has been realized that with the extended use of coal-face conveyors better local lighting is an essential condition to efficient working. Special lamps for the purpose have accordingly been evolved. Such lamps will continue to be used once it is recognized that intensive lighting pays.

* Abstract of a paper read before the North of England Institute of Mining and Mechanical Engineers.

Lighting from Mains and Special Methods.—There are inexorable natural conditions which will limit lighting in many mines to such as is portable, but where practicable there will certainly be extensions into our fourth section—lighting from the mains. The history of this development is of recent date. It has its origin—once more to the credit of Newcastle—in the work of Dr. Thornton.

There are at least five systems of lighting from the mains. There is also a form of auxiliary lighting which consists in a combination of a compressed-air turbine and turbo-generator and a lamp in one fitting, which is designed to run off a flexible pipe attachment to the air mains at the coal face. The idea originated in Johannesburg. Within the last few years it has been developed in England, and consists of a compressed-air turbine driving a 60-volt dynamo, which delivers current to a lamp; the whole being combined in one piece, which can be hung up in a convenient place. Not much is known regarding the possibilities of the lamp in practice; but evidently fluctuations in air pressure would give rise to flickering light. In another lamp since developed the pressure was accordingly reduced from 60 to 6 volts. This lamp weighs about 23 lbs. It provides an all-round candle-power of 60 or about 90, or a maximum beam-candle-power of about 600. The lamp is so designed that the exhaust air leaves the casing near the bulb, consequently it is impossible for any fire-damp to come in contact with the filament in the event of breakage. Moreover, as all spaces within the lamp are filled with compressed air, explosive gases cannot get in contact with any internal burn-out in the unlikely event of this happening.

The Substitution of Artificial Light for Daylight

In a recent issue of *The Electrical World* attention is drawn to a distinct tendency in large cities to replace natural by artificial light.

A few years ago some investigations of the cost of daylight led to the startling conclusion that natural lighting in many buildings was costing more than good artificial lighting. It was then predicted that daylight would eventually be considered more carefully with regard to cost, convenience and dependability. There was no intention of advocating the abandonment of daylight where it could be obtained at reasonable cost and in sufficient quantity. The object of the work was to reveal certain economic factors and to protect the user of light from costly errors due to habit. Artificial light had been decreasing so rapidly in cost, and at the same time increasing so greatly in controllability and quality, that the time had arrived for making comparisons.

It is pointed out that in congested districts, where ground and floor area and also wall space are valuable, some of the daylighting installed through habit or in earlier years is now relatively too costly. Furthermore, artificial lighting is often necessary on account of the certain failure of daylight once each day and of its undependability at all times. In many stores and offices it is always inadequate. In certain areas in large stores and factories it is insufficient in intensity most of the time. Excepting in single-story factories or on the top story the roof cannot be utilized efficiently for admitting daylight. Even in such cases a costly method of roof construction often is not economically justified for lighting in comparison with the cost of artificial lighting.

Several large auditoriums, one notable art museum and other new buildings have been designed without daylight in part of the structure or even in the entire building. A large store has just given up its windows in certain places, the space being more valuable than the meagre daylight. Other examples could be cited. In short the time has arrived for giving more attention to the economic value of natural lighting compared with artificial lighting.

The International Illumination Conference in the United States

WE have now received further particulars of the forthcoming International Illumination Congress, which is to be opened in New York this month. The list of delegates from abroad already approaches 70 and all the leading countries of the world will be represented. The entire month of September will be spent in discussing illumination in all its phases. Delegates are expected to arrive in New York on September 3rd, where several days will be spent in visiting places of interest in connection with illumination. On September 7th a tour will be made by special train, which will cover Boston, Philadelphia, Washington, Cleveland, Detroit, Chicago, Niagara Falls, ultimately bringing delegates to Toronto, where they will be welcomed at the twenty-second Annual Convention of the Illuminating Engineering Society (U.S.A.).

The convention will last throughout the period September 17th to September 20th. From Toronto the delegates will proceed to Saranac Inn, N.Y., where, from September 22nd to 28th, the meetings of the International Commission on Illumination will take place. The famous inventor, Mr. Thomas A. Edison, is honorary chairman of the Reception Committee.

The papers and reports to be presented at the session of the International Commission on Illumination are numerous and cover a wide ground. According to the programme before us there will be at least twenty distinct sections. Such matters as Street Lighting, Automobile Headlights, Problems in Photometry, Daylight Illumination, The Lighting of Schools and Factories, Lighting for Nerial Navigation, Coloured Signal Glasses, Colorimetry and Kinema Theatre Lighting will be dealt with.

The papers by British delegates include a review of the British Standard Specification for Street Lighting, by Mr. C. C. Paterson; "Daylight and Public Health," by Mr. P. J. Waldram; and "The Protection of Pictures and Museum Specimens from Fading," by Mr. J. A. Mackentyre and Mr. H. Buckley. Mr. Guild will deal with Yellow Glass for Railway Signals, and Mr. W. S. Stiles with Experiments on Glare.

Other countries will likewise be well represented. As regards France, we note that Professor A. Blondel is once more contributing a discussion of Photometric Nomenclature; M. R. de Valbreuze will discuss Lighting Education; and M. J. Wetzel will deal with the interesting question of Modernistic Lighting Fixtures. Special interest attaches to a paper by M. Leblanc dealing with the Influence of Illumination on the Efficiency of Workers, and there are other promised contributions from Professor C. Fabry, M. P. Bossu, and others.

From Germany comes a report on Street Lighting, reviewing all phases of the subject, including the relation of lighting to traffic, protection against accidents and crime, standardization, etc. We also note a contribution from Mr. L. Schneider treating the subject on a physiological basis. Germany is likewise responsible for several useful papers dealing with photometric problems and diffusing materials. There is also a series of papers from lighting experts in Japan dealing with Street Lighting, Kinema Theatre Lighting, etc.

Naturally there will also be important American contributions, amongst which we notice Mr Luckiesh's analysis of Research in Illumination, reports of the American Committee on the Lighting of Schools and Factories and Autumobile Headlights, and a review of Candle-power Standards by Messrs. E. C. Crittenden and F. B. Meyer.

We have not as yet received the programme of papers for the twenty-second Annual Convention of the American Illuminating Engineering Society, but no doubt these will be as varied and numerous as usual, so that those who are so fortunate as to participate in the Congress will find ample material put before them.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society; and is based on outside contributions.)

Light and Visibility

By W. J. JONES, M.Sc.

(E.L.M.A. Lighting Service Bureau.)

PART III

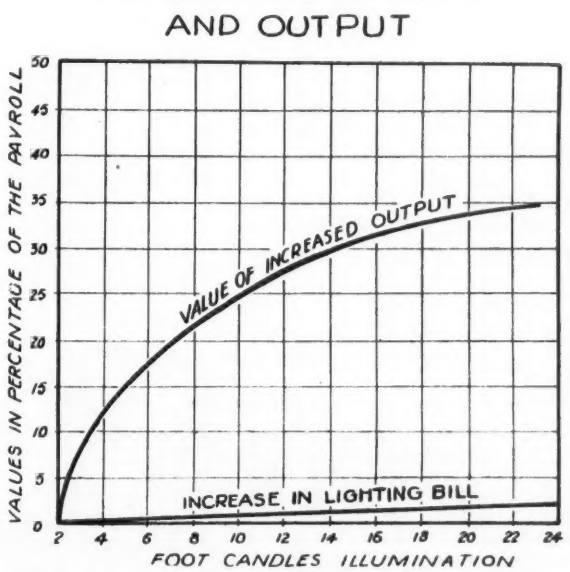
(*Continued from Page* 204, *July*, 1928.)

THE better performance of the eye under good illumination has an important influence in everyday life. It has been shown that the quicker operation of the eye and the reduction in fatigue brought about by proper lighting conditions give increased output per worker in industry. Indeed, the more and better light provided the greater the facility of seeing, and the only limitation appears to be an economic one, i.e., when the cost for providing the extra lighting approaches that of the value of the increased production. In practice this condition is seldom attained.

In 1923 an investigation was carried out in New York City post office, and involved the speed of sorting mails under different intensities of illumination, the whole of the tests being carried out under practical conditions and ordinary supervision, and the illumination itself being under the charge of eminent physicists. The speed of sorting was measured under the original system of lighting, which gave 3.3 foot-candles, and again with the new installation consisting of totally enclosed diffusing units spaced 10 feet apart and 10 feet from the ground, and giving an illumination of 8 foot-candles. It is interesting to note that not only was the increase in output obtained initially with the higher illumination but that the improvement was maintained. As a check on the tests, the illumination was reduced to approximately its original value, namely, 3.8 foot-candles, and immediately the output dropped.

The report of the Postmaster-General at Washington deals with the economic advantage of the increased illumination, and shows how considerable is the pecuniary advantage to be obtained from better lighting The extra cost for the better lighting was found to be only 1.5 per cent. of the pay roll, yet the improvement in the speed of working was as large as 12-20 per cent., or enough to pay for the extra lighting eight to twelve times over. Similar results were obtained by the British Medical Research Council, and the Department of Scientific and Industrial Research when investigating the speed of setting type under different intensities of illumination (economics chart). A full account of these tests and the economics involved was given in *The Illuminating Engineer* of February, 1927. In this instance it appears that the increased output is sufficient to pay for the extra lighting nine times over. It is quite obvious that there are other factors, such as the hygienic and psychological effects of light, but it is not proposed to enlarge upon these aspects in these notes.

Type of Lighting System Desirable.—Apart from psychological effects and the appearance of the lighting system, one would expect certain visual operations to required a more or less directive quality of illumination. What, for instance, is the character of the illumination best suited for typesetting? The later experiments of the Medical Research Council and the Department of Scientific and Industrial Research show that for type-setting a very considerable proportion of direct lighting is necessary, and that when totally indirect methods of lighting are employed there is not the same facility for seeing, and a corresponding drop in output is indicated. This is probably due to the fact that with direct or semi-indirect lighting equipment there is a considerable vertical component of illumination which enables the letters of the type to stand out in relief, the contrast brightness which facilitates vision being largely proportional to the ration of the horizontal to the vertical illumination. In the case of the totally indirect-lighting system the object would appear too flat.



The value of increased output will pay the extra lighting bill many times over.

Although direct or semi-indirect lighting equipment is probably most useful in 90 per cent. of industrial applications, it sometimes happens that the reverse is true, and that totally indirect lighting gives better visibility.

The recent tests of Mr. A. A. Brainerd in *The Electrical World*, 31st March, 1928, on " quality measurements " give an example of this. It was apparently

necessary to view the deep interstices in the machinery and to have them evenly lighted to be able to focus the eye on the details therein. Alternate patches of light and shadow produced by direct-lighting equipment very largely interfered with vision under these conditions.

There is another matter which requires consideration, namely, the desirability of installing general or a local system of illumination. Here again the investigations of the Medical Research Council and the Department of Scientific and Industrial Research give an indication that local lighting by itself is not as good as general lighting, and it seems that either a general system of illumination is to be preferred or at least a combined system in which the local lighting is supplementary to that of a general system. This is particularly true when very high intensities are required for such work as engraving. Some 10 foot-candles might be provided from a general system and 20 or more by the local system.

Effect of Glare.—The loss in visual efficiency of the eye due to glare found under laboratory conditions is confirmed under industrial and practical conditions. For instance, in street lighting the effect of glare is that of reducing the perceptibility, and in order to make up for this loss of perceptibility it would be necessary to—

(1) Either increase the general amount of light in the field of view several times.

(2) Ensure that the contrast afforded by an object on the road is much greater.

The relative importance of these various factors in visual operations is one well worth more investigation. In any event, it seems quite certain that the effect of glare is to lessen the efficiency of the installation, based upon visibility, by some 50 per cent.

Effect of Vibratory Conditions.—Quite an interesting aspect of light and visibility is that which is encountered in public conveyances, and the following experiments on the speed of reading and on the acuity of the eye show the necessity for maintaining an extra high degree of illumination in all vehicles which are subjected to either transverse or longitudinal vibrations.

Test on Bakerloo Railway:—

Newspaper 8-point type.

Illumination 2 foot-candles.

	When stationary.	When running.
Distance at which type could be seen clearly	3 ft.	2½ ft.
Speed of reading	220 words per min.	140 words per min.
Reduction in speed of reading under vibratory conditions ...		33⅓%
Reduction in acuity		30%

Other Tests:—

Top of tram—2-3/4 foot-candles.

Reduction in acuity when running, 12 per cent.

Top of bus (back)—8-point type.

Reduction in speed of reading when running, approximately 50 per cent.

Good lighting is a convenience greatly appreciated by the public, and one that can be provided for little extra outlay. In view of the above tests, it would appear that the standard of lighting already existing in many public vehicles could be profitably increased, providing thereby additional comfort to passengers. Values of illumination which at first sight seem abnormally high under stationary conditions become the least which should be provided under vibratory conditions. It seems, therefore, that at least double the light intensity is required in public vehicles than is necessary for reading in offices or libraries.

(*To be continued.*)

Sales of Electric Lamps in the United States

The report of the Lamp Committee presented last year at the fiftieth annual convention of the National Electric Light Association (U.S.A.) makes interesting reading.

The sales of standard "Mazda" lamps and tungsten-filament lamps totalled 294,000,000 during 1926. This represents a percentage increase of 11.8 over the sales for the previous year. Sales of miniature lamps for automobile headlights, Christmas trees, flashlight torches, etc., reached 47,000,000. The number of domestic carbon-filament lamps sold (2,750,000) was about the same as during the previous year. There was, however, an increase of 14.5 per cent. in the number of imported lamps of this kind. Of the total of 18,500,000 carbon-filament lamps sold for all purposes in 1926 the great majority (86.5 per cent.) were believed to have been selected on account of low initial cost or unusual shape. Out of 160 companies 126 reported that there were practically no carbon lamps sold within their territories.

Mr. W. E. Bush

NEW APPOINTMENT.

WE are interested to learn that Mr. W. E. Bush has accepted an appointment as general sales manager with Curtis Lighting (Europe), makers of the well-known X-ray reflectors and lighting equipment.

To readers of this journal Mr. Bush's name is familiar. He was formerly associated with the British Thomson-Houston Co. Ltd., but was appointed manager of the E.L.M.A. Lighting Service Bureau when it was inaugurated about five years ago, and he has since laboured incessantly on its behalf. He has been a member of the Illuminating Engineering Society for many years, and has taken part in many of its discussions. His new appointment will involve much travelling in Europe, and we hope that his duties will leave him leisure to keep us informed of developments in illuminating engineering abroad, which he will doubtless have special opportunities of studying.

ALWAYS

THE SAME GOOD LIGHT

It really is remarkable the way Mazda Lamps maintain their brilliance, week after week, month after month, without any appreciable diminution of light.

Suppose we say that the light from a certain electric lamp is equivalent to the light given by sixty candles. A Mazda Lamp holds on tightly to these candles, not merely for the first month or so, but right up to the end of its rated life.

A lamp that will do this is worth having—that's why you should get Mazda Lamps to-day.

B T-H

MAZDA LAMPS

2970

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2

FIG. 1.—Floodlighting with Blaizolite Lanterns at the Morden Depot of the London Electric Railway. Daylight view showing method of mounting lanterns.

Floodlighting on the Railways

A Novel Installation at the Morden Depot of the London Electric Railway

MUCH has been written regarding the application of floodlighting to the exteriors of buildings and for purposes of advertisement and spectacular illumination. But floodlighting has equally important industrial uses, to enable construction work to take place at night, and in connection with railways, docks, etc. The possibilities of this system on the railways, where large open spaces have to be treated and ordinary methods of lighting are only applicable with difficulty, deserve special notice.

In this country there are as yet not many installations of this kind to record, but by the courtesy of Messrs. Lewenz & Wilkinson Ltd. we are able to give some particulars of a recently installed system at the Morden depot of the London Electric Railway. Fig. 1 gives a general idea of the method of mounting the lights, which are of the " Blaizolite " type described in our last issue*. It will be recalled that this lantern utilizes a system of seven plano-convex lenses and six mirrors surrounding the lamp bulb, the whole being housed in a cylindrical body. These units are mounted at a relatively great height, usually not less than 30 feet, so as to be quite out of the range of view of persons standing on the ground. There are several factors which render this system valuable on railway lines where it is necessary to distinguish the points clearly and also to be able to see information on the backs of trucks, etc. As explained above, the units, being high up, are not liable to cause glare, for as soon as the driver approaches near to them they are cut off from sight by the edge of the cab. Moreover the light, though brilliant, is spread over a relatively large area by means of the system of lenses and mirrors and the diffusing glass front. The units are highly adjustable and give a concentrated beam which can be directed on any desired spot, e.g., so as to show up any special area where the points occur. In Fig. 2, which is a night view of the same installation, this effect is manifested. The intersection of railway lines is clearly revealed, and it may be noted that it is mainly by the reflection of the light-sources (as is the case in wet streets) that this revealing is effected. The fact that the light is spread over a fairly big area, and the band of reflected light is therefore wide, is advantageous in enabling railway lines to be seen.

In Fig. 2 a series of three units, each equipped with a 500-watt lamp, is shown. The distance between such sets of three units is about 680 feet. From the standpoint of the railway this limitation in the number of units is a distinct advantage. A large number of small units would be troublesome to maintain and liable to confuse the driver.

Whilst, as indicated above, it is mainly by reflection off the surfaces of the rails that their outlines are seen, the order of illumination produced by these units is also of interest. From the tests made at Morden it appears that the illumination, measured on a horizontal plane 3 feet above the ground, attained 0.1 foot-candle at a distance of 100 feet from the units, and even at 160 feet distance 0.04 foot-candle was still obtained. At distances of 20, 40 and 80 feet, 0.42, 0.24 and 0.13 foot-candles were recorded. The standard lantern equipped with a 500-watt gasfilled lamp is stated to yield a maximum candle-power of approximately 14,000. With 1,000-watt lamps this value is roughly doubled, and with the very latest type of lantern, equipped with 1,500-watt lamps, a beam candle-power of the order of 40,000 is anticipated.

The final illustration (Fig. 3) is of interest in giving an indication of the illumination that can be secured by the aid of these units. The back of the last coach is clearly revealed. It may also be mentioned that, contrary to the impression made by the picture, the train lights are not on. The appearance of internal illumination is produced solely by reflections of the distant floodlighting units directed upon the train.

* *The Illuminating Engineer*, August, 1928, p. 238.

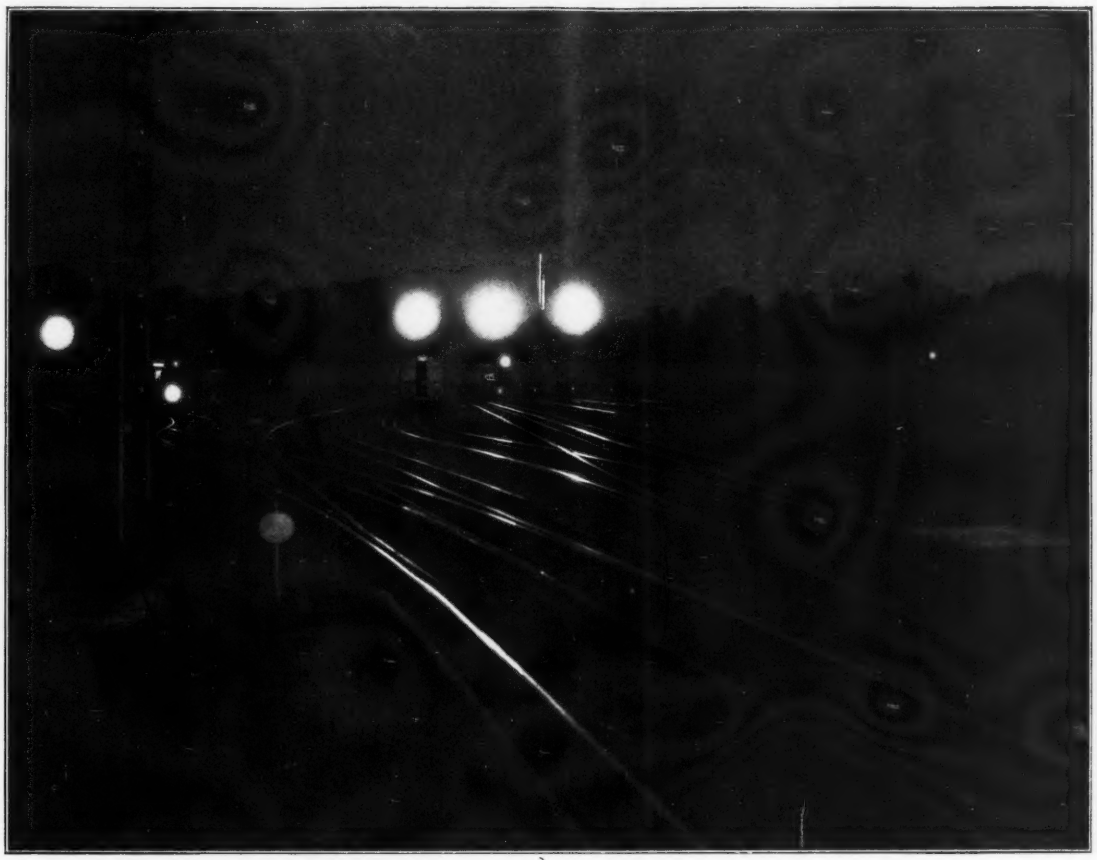


FIG. 2.—A night view of the same installation showing "moonlight" effect of the lanterns.

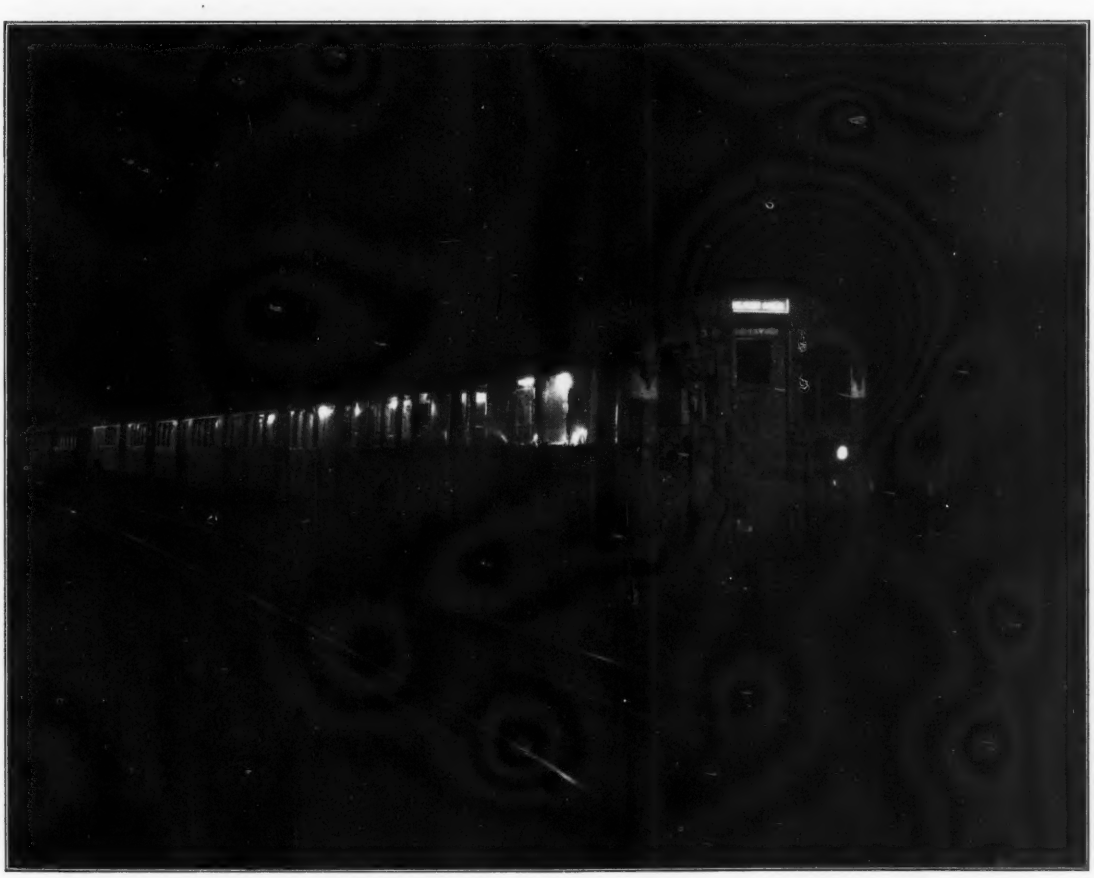


FIG. 3.—A siding with train showing ground illumination (interior lighting of train is switched off).

The Lighting of Placards, Train Indicators, etc.

A SOMEWHAT special problem in modern lighting is the illumination of large vertical surfaces, such as are met with in connection with advertising, hoardings, etc., and on the railways (notices, train indicators, time-tables, clock-faces, etc.).

Good lighting is not always easy to arrange in such cases. In general, the units must be so arranged as to leave a completely free view of the surface illuminated, and it is usually necessary to mount them quite close to it, so that special measures have to be taken to secure approximately uniform illumination and to avoid "patchiness." Moreover another difficulty intervenes;

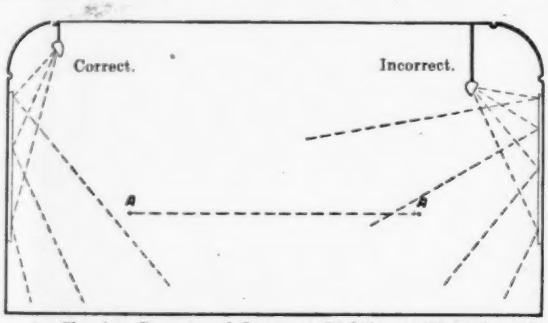


FIG. 1.—Showing Correct and Incorrect Lighting of Placards with polished surfaces (e.g., glass cases, clocks, enamelled plates, etc.).

such surfaces, especially when used on the railways, are liable to become grimy. They must be capable of being easily cleaned, and a more or less polished exterior is therefore advisable. For this reason the surface is usually varnished, or enamelled or protected with glass. This element of polish naturally affects the problem of securing uniform illumination. When the illumination is uniform the brightness may not be so, and tends to diminish on regions most remote from the lighting units. The position of the units also needs care; otherwise the observer's eye is liable to be distracted by bright reflections of the sources off the surface. This defect may be avoided by careful placing of the units and attention to the angles at which light is reflected.

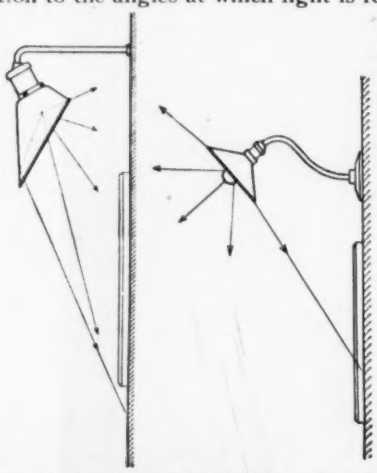


FIG. 2.—Another illustration showing Correct and Incorrect Lighting.

Fig. 1 is instructive in this respect. It shows, on the left, the correct placing of the lighting unit and on the right the wrong method. Assuming that the observer's eye is on a level with the line AA, it is evident that with the arrangement shown on the right the rays of light will be directly reflected into his eyes, whereas, with the arrangement shown on the left, the reflected rays pass below the line of vision, and therefore he does not see any troublesome images of the lamps.

Fig. 2 illustrates another obvious point—the necessity of screening lamps so that the filament is invisible to the observer. The reflector on the left achieves this, and it is also specially shaped with a view to illuminating adequately the lower regions of the placard, which is evenly illuminated. The arrangement shown on the right is utterly wrong, and yet one does see instances of this kind. Obviously very little of the light from the unit reaches the surface. Most of it merely dazzles the eyes of the observer. But, in any case, the simple conical shape of the reflector is unsuitable for producing the desired uniform distribution of light. If the unit were turned round so as to face the placard the filament would be hidden, but the surface would still be unevenly lighted.

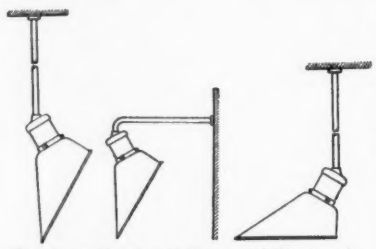


FIG. 3.—"Kandem" Units suitable for the Lighting of Hoardings, etc.

In Fig. 3 a form of "Kandem" unit specially suitable for the lighting of hoardings is illustrated. Attention may be drawn to the highly adjustable nature of the fittings, which can be turned at any angle so as to obtain maximum uniformity of illumination, and to suit surfaces of different sizes. A notable feature is the unusual contour given to this reflector, which has been specially designed for the lighting of large vertical surfaces.

In Fig. 4 we have a photograph showing effective lighting of the train indicator in a railway station in Germany. Notices of train departures now play an important part at all large railway stations, and not infrequently assume large dimensions. It is essential that such surfaces should be adequately illuminated so as to be visible from a distance, and that the source should be completely screened from the eye.

FIG. 4.—A good example of the Lighting of Train Indicators.

In Fig. 5 several types of parabolic reflectors suitable for work of this kind are illustrated. Such units assume various shapes, according to the angle at which the maximum light is desired. For railway work, robustness and ability to withstand the effect of smoke and

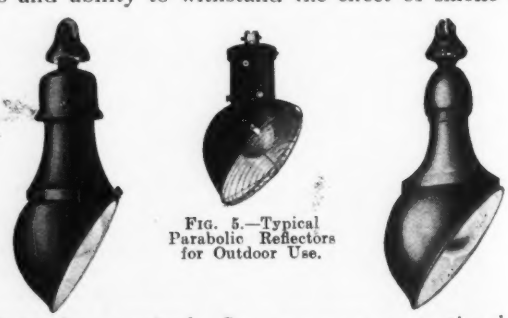


FIG. 5.—Typical Parabolic Reflectors for Outdoor Use.

moisture are required. In some cases protection by a wire basket, similar to that shown in the case of the central unit, is desirable.

We are indebted to Messrs. Korting & Mathiesen Electrical Ltd. for the use of the illustrations accompanying this note.

FACTORY LIGHTING

Forthcoming SPECIAL ISSUE

As our readers are aware, it is our practice to publish, from time to time, Special Issues, devoted chiefly to aspects of lighting that are attracting particular attention.

Thus our August issue was concerned with Street Lighting and contained a full account of the proceedings at the recent Conference of the Association of Public Lighting Engineers in Sheffield.

Our **next** (October) Issue will be devoted specially to **Factory Lighting.**

This problem will be exciting general attention during the autumn, and, as readers are aware, is being made the subject of an extensive campaign by the E.L.M.A. and B.E.D.A. organisations.

We have accordingly decided that our next number shall deal with industrial lighting. There will be articles dealing with general principles and specific problems in factory lighting, and emphasizing the benefits of good illumination. Allusion will be made to the section of the recently issued Report of H.M. Inspector of Factories dealing with this subject. The issue will be illustrated by descriptions of typical modern factory lighting installations.

We invite the co-operation of readers and advertisers in making this issue a useful one, alike to the lighting industry and the public. Readers are invited to send us particulars of any interesting problems in factory lighting or striking installations that have come within their notice. Advertisers are requested to take note of the contents of this coming special issue and to frame their advertisements accordingly. We hope that all leading firms in the lighting industry will take advantage of the publicity opportunities offered by this issue, which will be widely circulated amongst managers of factories.

All matter intended for this special issue should reach us preferably by **September 15th.**

"The Illuminating Engineer"

32, Victoria Street, LONDON, S.W.1

Modernizing Small Shops

EVERY merchant wants, so to speak, " a place in the sun "; that is to say, he seeks for his store a position which is in itself some guarantee that the contents of his windows will attract a fair measure of attention. Unfortunately the better the position the higher the rent, so that some compromise between his ambitions and the size of his purse is necessary. Not infrequently this compromise results in a diminution in the size of the shop. He has to be content with a narrow frontage and with a single entrance at the side of the one shop window.

Now as the show window is his most potent means of attracting public attention everything depends on his

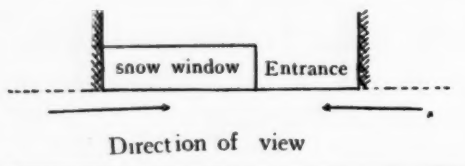


FIG. 1.

making the best possible use of the space available, and on causing it " stand out " from the long series of windows of his neighbours.

In discussing this problem it is well to bear in mind that one is not necessarily concerned with a new shop. Just as frequently one has to consider existing premises, and the question arises how these may be made more attractive.

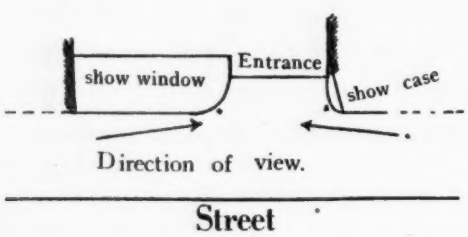


FIG. 2.

Generally speaking, the most common mistake of small shopkeepers is to adopt a continuous line for the window and the entrance. In these circumstances we have the arrangement illustrated in Fig. 1. The inevitable result is that the glance of the passer-by is not held, but passes quickly along the uniform line to other windows. Consequently he may hardly notice the small window, which is sandwiched in between adjacent larger ones, and much of its advertising value is lost.

One possible way of avoiding this dilemma is illustrated in Fig. 2. Here the entrance to the store is set back, and the window curves inward towards the door. In these circumstances the glance of the passer-by is more likely to be arrested by the window. The eye of a person coming in the opposite direction may be held by the addition of a small showcase on the other side of the door. This arrangement is shown in elevation in Fig. 3. The store entrance, being set back, appears less prominent. The window commands attention, and the passer-by, in viewing its contents, is unconsciously lured into the shop, being, in fact, half-way inside already.

The drawing power of a window thus constructed is already enhanced, but much naturally depends on the contents of the window and on the manner in which it is lighted. In general, a curved window pane should

FIG. 3.

be used; and it is essential to use only the best quality of glass, otherwise objects within the window will be distorted. The alternative plan, sometimes adopted, of putting a vertical cross-piece at the corner of the window is not advised, for in this case the sweep of the window is broken and the good side effect is partly lost.

R. M.

Floodlighting at the E.C.A. Conference

The E.C.A. Conference recently held in Cheltenham proved to be thoroughly successful. About 400 electrical contractors, representing 32 branches of the Electrical Contractors' Association, were present, and the papers read (" Earthing as a Safeguard to the Public," by W. R. Rawlings, " Electrical Development, with special

Cheltenham Municipal Offices floodlighted by G.E.C. Projectors and Osram Lamps.

reference to Retail Sales," by J. Orringe, and " Trading without Tears: the E.C.A. Policy," by H. Marryat) were interesting.

On this occasion there was no paper dealing specially with illumination, though several (Mr. Rawlings' contribution in particular) contained suggestions which have a direct bearing on successful lighting installations. There was, however, one item in the proceedings of considerable interest to illuminating engineers—the floodlighting of the Cheltenham Municipal Offices, which was carried out by the General Electric Company Ltd. The accompanying illustration gives a good idea of the effect. We are glad to see that such special floodlighting installations are becoming a familiar feature at engineering conferences, when they act as a useful object lesson, and are seen by those most likely to appreciate them.

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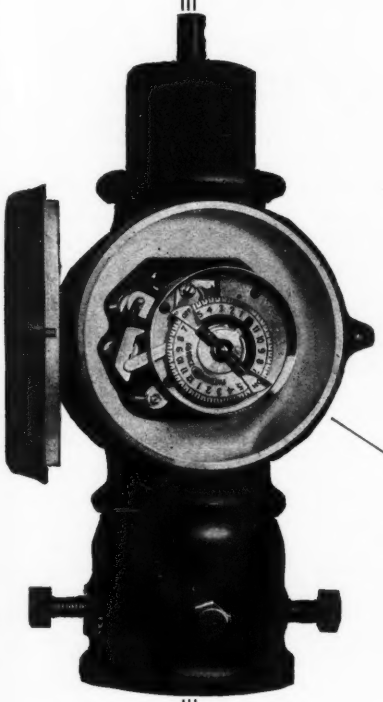

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TRADE NOTES & ANNOUNCEMENTS

ELECTRICAL ENTERPRISES IN SOUTH AFRICA.

We are informed that the British General Electric Co. Ltd. has just opened new showrooms at the South African headquarters of the Company in Johannesburg. These headquarters, comprising a four-story building of imposing proportions, with frontages to Loveday, Anderson and Frederick Streets, form one of the architectural features of the town. The ground floor, second and third floors are used as stockrooms, the first floor being set aside for offices and showrooms. The reconstruction of the latter on Tudor lines, which is inspired by the methods adopted at the home headquarters (Magnet House) in London, has just aroused much of interest among the trade and the public, particularly as showrooms of such a nature are unique in South Africa.

The showrooms are designed to display electric light fittings and fixtures and electric household appliances, and in connection with the last named a completely equipped domestic kitchen has been built at the end of the main showrooms.

In providing such showrooms, the G.E.C. is following the practice which it has adopted with such success in London and many provincial centres at home, and the pioneer work it is doing in the case of Johannesburg will doubtless meet with similar success in South Africa.

HOLOPHANE LIGHTING IN CRITTALL'S MODEL FACTORY.

A very attractive leaflet, which accompanies a special offer to demonstrate better lighting by Messrs. Holophane Ltd., contains some data on the lighting of the new model fittings factory of the Crittall Manufacturing Company at Silver End, which is surrounded by a model village for the accommodation of workers. Judging by the photographs, the overhead lighting by means of Holophane industrial units is most effective, and the adoption of the Holophane system by a firm of such repute should be regarded as a gratifying indication of its possibilities.

THE BENJAMIN REFLECTOR.

We have previously drawn attention to this ingenious folder leaflet, circulated by Messrs. Benjamin Electric Ltd., and attractively featured in green and black. The May–June issue contains a very imposing night photograph of the Enfield Cable Works, Brimsdown, which is illuminated by central overhead units, supplemented by side units. In an introductory note entitled "The Measure of Man" the importance of good industrial lighting is emphasized, and elsewhere the main requirements of correct illumination are briefly summarized. Another useful device is the "Illumination Data Form" circulated with the leaflet. This invites managers of factories to set out brief details of their present lighting equipment and the class of work carried on, as a preliminary to possible improvements.

"WIGAN" PRISMATIC BULKHEAD FITTINGS.

A little booklet issued by Messrs. Heyes and Co. Ltd., of Wigan, illustrates the special bulkhead fittings manufactured by this firm, to which attention has been previously directed in this journal. The chief features of these fittings are their compactness and robustness and the extensive curve of illumination yielded by the special prismatic device. These fittings are excellent in cases where overhead space is limited, and, when recessed in the ceiling, give good results for the lighting of underground passages. Samples of the industrial type fitting have been approved by the Home Office for use in rubber works, petrol depôts, etc.

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REQUIRED—Gentlemen with wide experience in electrical goods, for London and the Principal Towns, by the largest Wooden Electric Fitting Co. Apply to:—

THEODOR MÜLLER & Co., G.m.b.H.
Detmold, Germany.

A view of the new premises of the General Electric Co. Ltd. in Johannesburg.

OPTICAL INSTRUMENTS.

We have received from Messrs. Adam Hilger Ltd. a copy of their recently issued general catalogue of optical apparatus. Messrs. Adam Hilger Ltd. have a high reputation for this kind of work, and the catalogue bears witness to the variety of apparatus now manufactured. The catalogue contains nine distinct sections, perhaps the most important being that dealing with spectroscopic and spectrographic apparatus. We notice that five distinct instruments are illustrated in the section on photometric and calorimetric apparatus, amongst which the Guild trichromatic calorimeter, the Nutting calorimeter and the ingenious Mutochrome deserve special mention. The catalogue is fully illustrated, and carries at the end an adequate index—a useful item where such a wide variety of instruments is dealt with.

"BLAIZOLITE" LANTERNS.

We are asked to mention that the "Blaizolite" lanterns referred to in our last issue in connection with the demonstrations of street lighting in Sheffield are manufactured by Messrs. Norrington & Landon Ltd. (of 33, Brazennose Street, Manchester), who are represented in London by Messrs. Lewenz & Wilkinson Ltd., of 25, Victoria Street, S.W.1.

ERRATA.

Our attention is drawn to the fact that in our note on "Diffusing Glassware," on page 245 in last issue, the name of Messrs. Regants Ltd., of Shepherd's Bush Green, was incorrectly spelt.

We also regret that by an oversight the wrong polar curve of light-distribution was associated with the "Mirrorlite" lantern supplied by Messrs. Korting & Mathiesen Electrical Ltd. (page 234). The correct curve, showing the characteristic "peak" at about 60°, appeared in the advertisement of this firm (page v). Readers will recall that we described this novel type of lantern in our June issue.

CHANGE OF ADDRESS.

Messrs. Restlight Ltd. have recently removed their business, and their present address is Aldwych House, Aldwych, London, W.C.2.

CONTRACTS CLOSED.

The following contracts are announced :—

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD. :—
H.M. Office of Works; ten months' supply of Siemens standard gasfilled and vacuum lamps.

METRO-VICK SUPPLIES LTD. :—
Port of London Authority; for Metro-Vick gasfilled lamps for the six months ending December 31st, 1928.

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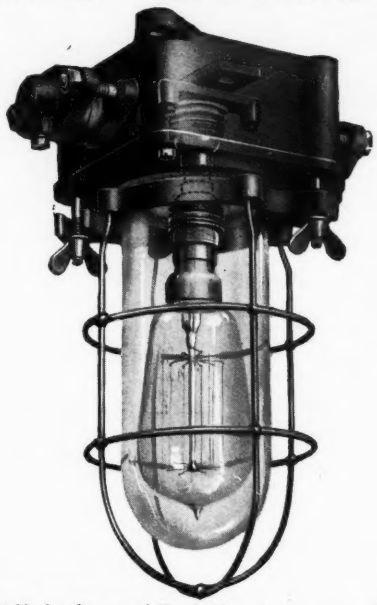
WATER-TIGHT
LAMP FITTINGS



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This book deals impartially with modern systems of lighting—gas, oil, electricity, and acetylene—and discusses their practical applications. A feature is the variety of illustrations, many of them reproduced from photographs taken entirely by artificial light. The new edition has been brought into conformity with the most modern practice, and forms a complete work of reference.

CONTENTS: History and Development of Methods of Illumination—Gas Lighting—Electric Lighting—Oil, Petrol-Air Gas, and Acetylene Lighting—Illumination and the Eye—Colour and the Eye—Measurement of Light and Illumination—Globes, Shades and Reflectors, and Calculations of Illumination—Problems in Interior Illumination—Outdoor Lighting—Searchlights and other Appliances for the Projection of Light—Index.

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GAS MANTLES
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INDUSTRIAL LIGHTING.

A catalogue devoted to Industrial Lighting is issued by the Edison-Swan Electric Co. Ltd. Brief data are given on illumination intensities and the calculation of illumination. A wide range of Benjamin reflector fittings is illustrated, and a few special units, such as trough reflectors for shop lighting, are also included.

FURSE ELECTRICAL SUPPLIES.

A useful but somewhat unusual list, without illustrations, is that issued by the Furse Wholesale Ltd. This contains prices of a wide range of lighting accessories, and should be useful to contractors. A special feature is the offer of surplus stock at reduced prices, all of which is stated to be quite good material.

"ATRAX" SPECIALITIES.

Several leaflets sent us by Messrs. Ascog Ltd. illustrate the variety of ingenious advertising devices furnished by this firm. Very simple are the "Atrax" translucent cubes, which can be designed to carry any desired advertising device and can be built up to yield novel patterns. Attention is drawn to the "Atrax" Phantascope, an arrangement for producing alternately two stereoscopic pictures. Such illuminated pictorial advertisements are widely used by railway and steamship companies, and reproductions of a number of travel scenes are included in the booklet. This form of luminous sign has great artistic possibilities, and in view of its mild luminosity will be preferred by many people to violently scintillating luminous signs. Another novelty is the "Atrax" flashing lamp, which includes a small thermostat in the cap. Such lamps, therefore, need no extraneous flashing device, but continue to yield alternate periods of brightness and darkness, the flash lasting 2 to 4 seconds and the dark period 1½ to 2 seconds.

SIEMENS MONTHLY LIST.

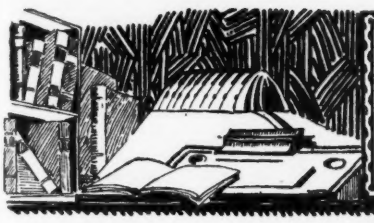
The familiar current Siemens Price List (August), as usual, contains much condensed information, and furnishes a useful guide to consulting engineers and consumers generally on current prices of lamps and lighting accessories. From Messrs. Siemens Electric Lamps and Supplies Ltd. we also receive their recently issued catalogue (No. Z122), dealing with Ironclad fuse and switchgear. "Ironclad" specialities are now very widely used, and the complete range of fuse boxes, change-over switches, mining type switch fuses, fuseboards, etc., illustrated, will answer practically all ordinary requirements.

"BRIGHT STAR" BATTERIES IN THE UNITED STATES NAVY.

This is the title of a small booklet which contains a number of effective illustrations showing the wide applications of these batteries and flashlights by the navies of the world. For work at sea dry batteries may often be kept for a considerable time before they are utilized. A feature claimed for the "Bright Star" batteries is that they do not deteriorate rapidly when kept in store. These batteries are in demand officially, but it is mentioned that officers and men also purchase them freely with their own money for private use.

"DUPLEX-A-LITE" SPECIALITIES.

From the Meriden Co. (Conn., U.S.A.) we receive a series of publicity leaflets dealing with "Duplex-a-lite" specialities. Each page shows a different form of fitting and an imposing list of prominent buildings in which it is used. We understand that these units are by no means unknown in this country, being supplied by Messrs. L. G. Hawkins & Co.



REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

NAVAL ELECTRICAL MANUAL, VOL. I. (*Published by H.M. Stationery Office, Kingsway, London, W.C.*, 1928; *pp.* 812, *xl*; 12*s.* 6*d. net.*)

This work (which supersedes "Torpedo Manual, Vol. I, 1911") has been prepared by Professor Fortescue for the guidance of officers and men of H.M. Fleet. Vol. I contains 30 chapters, which cover a wide field of electrical engineering as applied to naval work. The initial chapters deal with fundamental principles of electricity and magnetism. Subsequent chapters deal in detail with direct and alternating current machinery, electrical power transmission systems, telephony and telegraphy, etc. To our readers Chapter XVI, dealing with illumination, is of special interest. Early sections of this chapter deal with radiation, the effect of light on the eye, colour, and artificial daylight. (The author is surely in error in attributing to the Sheringham Daylight Co. the use of a composite glass screen for the correction of artificial light, the Sheringham method being primarily based on reflection.) The treatment of photometry follows familiar lines. One would like to see the treatment of illumination photometers extended by the description of various modern types, but we notice that reference is made to the special photometer used by the Illuminating Engineering Society for the study of light from flares and star-shells during the war. After a brief explanation of polar curves and calculations of illumination, the remainder of the chapter is devoted to searchlights. In the next edition one would like to see some hints on the lighting of warships included—though possibly this is reserved for special treatment in Vol. II.

AMERICAN PHILOSOPHICAL SOCIETY; BICENTENARY CELEBRATION, 1927. (*American Philosophical Society, Philadelphia, U.S.A.*, 1927; *pp.* 759.)

This volume contains a summary of the proceedings at the Bicentenary Celebration of the American Philosophical Society last year. The Society has no exact parallel in this country. Its proceedings are partly scientific, partly literary and partly philosophical. This bicentenary volume contains a sketch of its long and honourable career. It had its origin in the "Junta," founded by Benjamin Franklin in 1727, and it has included amongst its members many famous men. The thirty-two papers included in the volume deal with such subjects as biology, acoustics, astronomy, history and education. There is an interesting review of the work of Roger Bacon, best known as the discoverer of gunpowder, but also the author of a remarkable investigation of the rainbow. To illustrate the variety of matter we may quote a few more titles: "Platonism and the History of Science," "The Idiom of Jutland," "Recent Developments in Spectroscopy," "Sea-Level Surfaces and the Problem of Coastal Subsidence," "Democracy and the Control of Foreign Affairs." It will be seen, therefore, that members are introduced to a wide range of knowledge. The volume is excellently printed and has a necessary and adequate index.

ILLUSTRATED TECHNICAL DICTIONARIES.

Messrs. Lewenz & Wilkinson Ltd. announce that they will shortly be issuing the revised edition of Vol. II on Electrical Engineering, which has been completely rewritten and extended. Further new volumes in preparation will deal with the art of communications (including wireless), mining, aeronautics and chemistry.

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SPECIAL INFORMATION.

THE ILLUMINATING ENGINEER (the Journal of GOOD LIGHTING) was founded in January, 1908, and has thus been in existence for twenty years.

SINCE the year 1909, when the Illuminating Engineering Society was founded in London, it has been the official organ of the Society.

IT is *the only journal in this country exclusively devoted to Lighting by all Illuminants.*

IT receives the assistance of contributors who are leading experts on illumination in this country and abroad. Foreign Notes and News will be a speciality, and correspondents have been appointed in all the chief cities of the world.

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Good Lighting is of interest to everyone. The Journal is read by engineers, architects, medical men, factory inspectors, managers of factories, educational authorities, public lighting authorities, and large users of light of all kinds.

BESIDES being issued to all members of the Illuminating Engineering Society, the Journal has an independent circulation amongst people interested in lighting in all parts of the world. The new and extended form of the Journal should result in a continual and rapid increase in circulation.

Every reader of THE ILLUMINATING ENGINEER, the Journal of GOOD LIGHTING, *is interested in illumination, and is a possible purchaser of lamps and lighting appliances. Gas and Electricity Supply Undertakings likewise benefit by the movement for Better Lighting, with which the Journal is associated, and which stimulates the demand for all illuminants.*

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The Society preserves an impartial platform for the discussion of all illuminants, and invites the co-operation both of experts on illumination and users of light; it includes amongst its members manufacturers, representatives of gas and electric supply companies, architects, medical men, factory inspectors, municipal officers, and many others interested in the use of light in the service of mankind.

The Centre for Information on Illumination.

For particulars apply to:

J. STEWART DOW, *Hon. Secretary*,

32, Victoria Street, LONDON, S.W. 1.